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# Size and shape of steady seawater intrusion and sharp-interface wedge: The polubarinova-kochina analytical solution to the dam problem revisited

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## Abstract

© 2016 American Society of Civil Engineers.Rescaling of the geometrical sizes and the value of hydraulic conductivity in the classical problem of steady two-dimensional (2D) potential seepage through a rectangular earth dam with an empty tailwater is shown to result in a mathematically equivalent problem of seawater intrusion with a sharp interface into a confined horizontal aquifer, which discharges fresh groundwater to the sea through a vertical segment of the beach. The shape of the interface, the vertical and horizontal sizes of the static intrusion wedge, and its cross-sectional area are written in an explicit form, using the Polubarinova-Kochina formulas, rectified. The densities of the two liquids and the aquifers' hydraulic conductivity and thickness, as well as the incident hydraulic gradient serve as input parameters. With reduction of the incident groundwater gradient far upstream from the intrusion zone (due to, e.g., freshwater abstraction by wells), the sizes of the wedge rapidly increase. The analytical solution has been validated with recent sand tank experiments.

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## Keywords

Earth dam problem, Exact solution, Seawater intrusion, Sharp-interface model, Steady potential phreatic flow